



PHENIX XENON GAS COMPRESSION SYSTEM OPERATION PROCEDURE

procedure name

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REVISION CONTROL SHEET

LETTER	DESCRIPTION	DATE	AUTHOR	APPROVED BY	CURRENT OVERSIGHT
A	First Issue (reviewed 5/31/07 and found to be up to date)	11/12/2004	R. Pisani	D. Lynch, R. Pisani, R., Giannotti, A. Etkin	R. Pisani

Operating the PHENIX Xenon Recovery System

1.0 Purpose and Scope

The scope of this procedure is those operations that are necessary for running the East Transition Radiation Detector (TRD) with a mixture of 45%He + 45%Xe + 10% CH₄ using the TEC /TRD gas system, see Fig. 1, together with the Xenon Recovery Compression system.

Operations in this procedure include the following:

1. Purging the Xenon Recovery System (XRS) with inert gases.
2. Purging the XRS with the mixture of 45%He + 45%Xe + 10% CH₄
3. Normal Operation Mode
4. Switch out of full bottles

In the operation described here, inert gases (Nitrogen and Helium) and the mixture are routed from the TRD. The gas flow in the TRD Vent Line is typically 0.5 - 5 LPM at a pressure of 2 mmWC. Critical pressures and flows of the gas system are monitored by a hardware alarm box as well as a dedicated computer program.

The primary purpose of this operation is to recover the Xenon mixture from the TRD exhaust for the duration PHENIX operations.

2.0 Prerequisites

2.1 Required training to operate the Xenon Recovery System in the manner described in 1.0 above:

- 2.1.1 BNL General Employee Training (GET)(V-001)
- 2.1.2 BNL Compressed gas safety course (OSH026)
- 2.1.3 AD-CA Collider User Training
- 2.1.3 TEC/TRD gas system and Xenon Recovery System authorization required
(List posted in Phenix Mixing House).

3.0 Precautions

- 3.1 Over pressurization of the TRD (above 7 mmWC) will result in severe structural damage. Primary care should be given to monitoring the internal pressure of the East TRD throughout the duration of this procedure, especially when adjusting flow rates and when the hardware and software alarms are bypassed.
- 3.2 Pressure on the down stream side of the compressor can reach 1500 psi. Caution should be taken when operating the system.

4.0 Procedure

4.1 Initial Setup

NOTE: The following procedure assumes that the East TRD has been flushed with nitrogen and that auxiliary systems have been turned on. Xenon Recovery System pipes and tanks were purged with inert gas (at least 24 hours). Both cylinders have been evacuated.

- 4.1.1 Confirm that MV10 located at the top of the TRD rack is turned to the vent
- 4.1.2 Confirm that MV11, MV12, MV13, MV14, MV15, C1 and C2 are closed.
- 4.1.3 Confirm that the compression system switch is in the off position.
- 4.1.4 Disconnect C1 and C2 from the system
- 4.1.5 Start N2 flow to compressors cam

4.2 Purging the Xenon Compression System with inert gases (nitrogen)

- 4.2.1 Close MV11, MV14, MV15, MV16
- 4.2.2 Attach Line to N2 purge.
- 4.2.3 Close MV12, Open MV13 to vent
- 4.2.4 Turn compressor system on.
- 4.2.5 Open N2 purge, adjust flow to 3lpm.
- 4.2.6 Flow at this rate for 24hrs.
- 4.2.7 Attach TEMP vent to MV16
- 4.2.8 Open MV16, Close MV13
- 4.2.9 Purge gas through MV16 for 30 mn.
- 4.2.10 Turn Off Compressor, Close N2 Purge Valve.
- 4.2.11 Attach N2 To MV16 (needs at least 10psi.)
- 4.2.12 Open MV14 and MV15
- 4.2.13 Open SV1 then SV2 to purge lines for 1 mn each.
- 4.2.14 Close MV16, MV14 and MV15.
- 4.2.15 Remove N2 from MV16 and install plug.
- 4.2.16 Attach C1, C2 (bottles should be evacuated or back filed with TRD Xe mixture)

NOTE: Once an acceptable leak rate has been established, go to East TRD flow with 45%He + 45%Xe + 10% CH₄

4.3 Purging the Compression system with a mixture of 45%He + 45%Xe + 10% CH₄

- 4.3.1 Turn MV10 to VENT
- 4.3.2 Start mixture flow to the TRD
- 4.3.3 Purge system for at least 3 turnovers.
- 4.3.4 Open MV11, MV13
- 4.3.5 Turn MV10 to compression system

- 4.3.6 Set upper setpoint on PIS1 to 2.0 psi.
- 4.3.7 Set lower setpoint on PIS1 to 0.5psi.
- 4.3.8 Turn on compressor
- 4.3.9 Purge compression system with mixture for 3 turnovers. (depends on vent flow)
- 4.3.10 Close MV13,
- 4.3.11 Turn MV10 back to vent.

NOTE: While purging the system with the xenon mixture. The compression system may be turned on to recover gas that can be returned to the manufacturer for credit. Mixture at this time will not be 45/45/10. These bottles should not be used as makeup gas for the system.

4.4 Compression system initial set up.

- 4.4.1 Be sure MV12, MV16, MV13, MV14 and MV15 are closed.
- 4.4.2 Set upper setpoint on PIS1 to 2.0 psi.
- 4.4.3 Set lower setpoint on PIS1 to 0.5psi.
- 4.4.4 Connect C1 and C2 to system
- 4.4.5 Open C1, C2 and MV14, MV15, Be sure MV11 is Open
- 4.4.5 Turn MV10 to the compression system
- 4.4.6 Turn Compression system on and select bottle C1 as the primary bottle.
- 4.4.6 Push reset on C1 to open solenoid SV1

NOTE: System will automatically switch from the primary bottle to the secondary bottle when the pressure reached 1400psi (about 10-15 days). An indicating light will display when this happens on the Compression system control panel.

4.5 Switching Bottles when C1 is full

- 4.5.1 Close MV14 and C1
- 4.5.2 Remove C1 from system
- 4.5.3 Connect new evacuated (or purged) bottle (CGA 350) to C1
- 4.5.4 Open MV14 and C1
- 4.5.5 On Control Panel, turn primary switch to C2
- 4.5.6 On Control Panel, press the reset on C1

C2 is now the primary bottle.

4.6 Switching Bottles when C2 is full

- 4.5.1 Close MV15 and C2
- 4.5.2 Remove C2 from system
- 4.5.3 Connect new evacuated (or purged) bottle (CGA 350) to C2
- 4.5.4 Open MV15 and C2
- 4.5.5 On Control Panel, turn primary switch to C1

4.5.6 On Control Panel, press the reset on C2

C1 is now the primary bottle.

4.6 Purging the Xenon Compression System with inert gases at end of run

When the TRD is switched to inert gas at the end of run, continue running the compression system to recover remaining xenon from the TRD. Cylinders should be marked to indicate that they will not have the proper 45/45/10 mix. The system should be run like this for 2 weeks to recover all xenon.

Schematics

Fig. 1 shows a schematic of the Xenon Gas Compression system placed on the current vent line from the TRD gas Rack. The physical location of the recovery system is the South West corner of the Phenix Gas Mixing House. The 400 liter tank is located just outside the southwest wall. The compression system operated independently of the TRD rack but has alarms which are integrated into the existing TEC gas system alarms which are reported to the PHENIX control room..

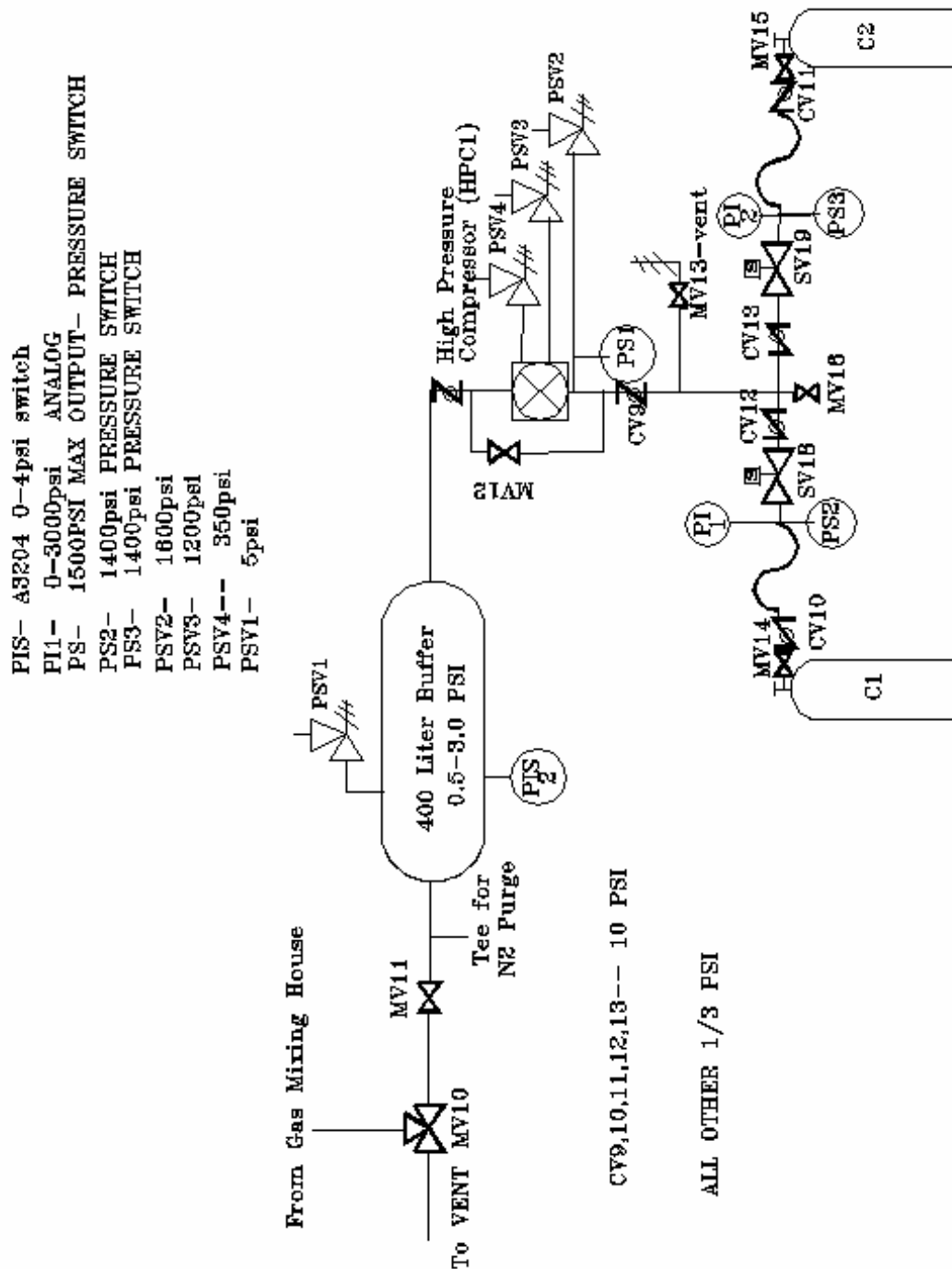


Fig. 1. PHENIX TEC/TRD Xenon Recovery System

The recovery system compresses the vented gas of the TRD system into one of 2 gas cylinders. The system includes a 400 liter buffer, a high pressure compressor (set to 1500 psi max, 1600psi relief), a low pressure indicating switch to control the pressure in the buffer tank, and 2 pressure switches and solenoid valves to control switching between the two cylinders automatically. The gas can then either be reintroduced into the TRD system or it can be sent to the manufacturer for xenon credit.